UK Water Industry
GIVES LDO™ THE THUMBS UP

Author Details

Nikki Mellor
HACH LANGE Ltd
Tel: 01256 333 403
Fax: 01256 330 724
Email: nikki.mellor@hach-lange.co.uk

WATER
Waste Water

- ***A new technology for measuring dissolved oxygen has been very successfully trialled all over the UK.***
- ***Operators from 7 water companies have used the LDO™ (Luminescent Dissolved Oxygen) over the past 10 months.***
- ***The LDO™ manufacturer makes startling claims for the performance of this sensor – find out if the claims are justified.***

Water Companies are constantly in search of technologies that can both improve processes and provide operational savings, and one such area of potential improvement lies with the measurement of dissolved oxygen. A new sensor known as the LDO™ was launched at IWEX 2003 amid a blaze of publicity in which the manufacturer claimed that most of the problems associated with dissolved oxygen measurement had been eliminated.

A part of the launch involved a number of UK Water Companies that put the LDO™ on trial in their wastewater treatment plants. Most of these trials have now been running for several months, so this article will summarise the experience to-date of these operators. However, before outlining the users' responses, a description of the historical problems with dissolved oxygen (DO) sensors will be given, in addition to an overview of the LDO™'s method of operation.

Many water treatment technologies involve aeration in order to maximise the effectiveness of bacteriological degradation. However, in addition to the need for ideal bacteria growth, it is essential that wastewater is not aerated excessively because this would result in a significant loss of energy, and it has been estimated that 60 to 70% of a treatment plant's energy costs come from the aeration of activated sludge. It is obvious therefore, that accurate DO measurement represents a vital component of successful plant management.

For more than fifty years galvanic and polarographic sensors have been used to measure dissolved oxygen. These sensors employ membranes, anodes, cathodes, and electrolyte solutions that generally require a high degree of maintenance. The sensors also suffer from drift, and as a result have to be recalibrated frequently.

Historically, there have been a number of problems associated with galvanic and polarographic sensors. The membranes are relatively delicate, and can become contaminated or damaged, in which case it would be necessary to replace the internal electrolyte. The sensor's anode is consumed over a period of time and will require replacement, or it may need replacement if it, or the electrolyte, becomes poisoned by gases such as hydrogen sulphide.

There are other factors that can affect the accuracy of these traditional sensors, including variations in pH or the presence of chemicals that induce voltage, such as iron and aluminium salts, and polymers.

The manufacturer of the LDO™ claims to have solved these long-standing problems with the launch of a sensor that, in contrast to its predecessors, does not consume oxygen as part of the measurement process, and does not require frequent recalibration because it does not suffer from drift (gradual loss of accuracy). So, how does it work?

The sensor is coated with a luminescent material, called luminophore, which is excited by blue light from an internal LED. As the luminescent material relaxes it emits red light, and this luminescence is proportional to the dissolved oxygen present. The luminescence is measured both in terms of its maximum intensity and its decay time. An internal red LED provides a reference measurement before every reading to ensure that the sensor's accuracy is maintained.

Reports from LDO™ users

Anglian Water operates an Innovation Centre that is responsible for the evaluation of new technologies in wastewater and process improvement. It recently ran a trial on a range of DO probes, including the LDO™, and trial manager Michael Marsh reported that "the trial only lasted for 10 months, so it is not possible to draw any long-term conclusions, however, the LDO™ which was used for 2 months out of the 10 proved to be very accurate, and required no maintenance." Nevertheless, Jeff Copping, a Process Optimiser for Anglian Water has been using LDO™ technology at Jaywick STW near Clacton in 3 activated sludge lanes for the last 9 months. Looking back, Jeff notes, "no maintenance has been required whatsoever, except for occasional wipes –you can be as rough as anything. All you need is a bucket and a cloth" In Jeff's experience the re-calibration of older DO probes was not particularly arduous, however, he concedes that whilst the lack of maintenance required by the LDO™ is a bonus, the savings in consumables cost is significant. "Just changing the cap every year sounds great – a win, win situation," he says.

Anglian Water have also used the LDO™ at Corby STW in a 'Kaldness Reactor' which incorporates thousands of tiny plastic shapes with a very high surface area to encourage the growth of bacteria. These plastic pieces have sharp edges that represent a highly abrasive medium, and traditional DO probes have had to be protected with an additional membrane. The LDO™ probe was trialled, unprotected, by Nigel Tomlinson an Electrical Controller, and the luminophore was eroded in six to eight weeks, however, he then mounted the probe upside down and has now experienced in excess of four months trouble-free operation. Nigel has not had to undertake any recalibration of the LDO™ and comments that "its accuracy has been very similar to the previous DO probes – its been great"

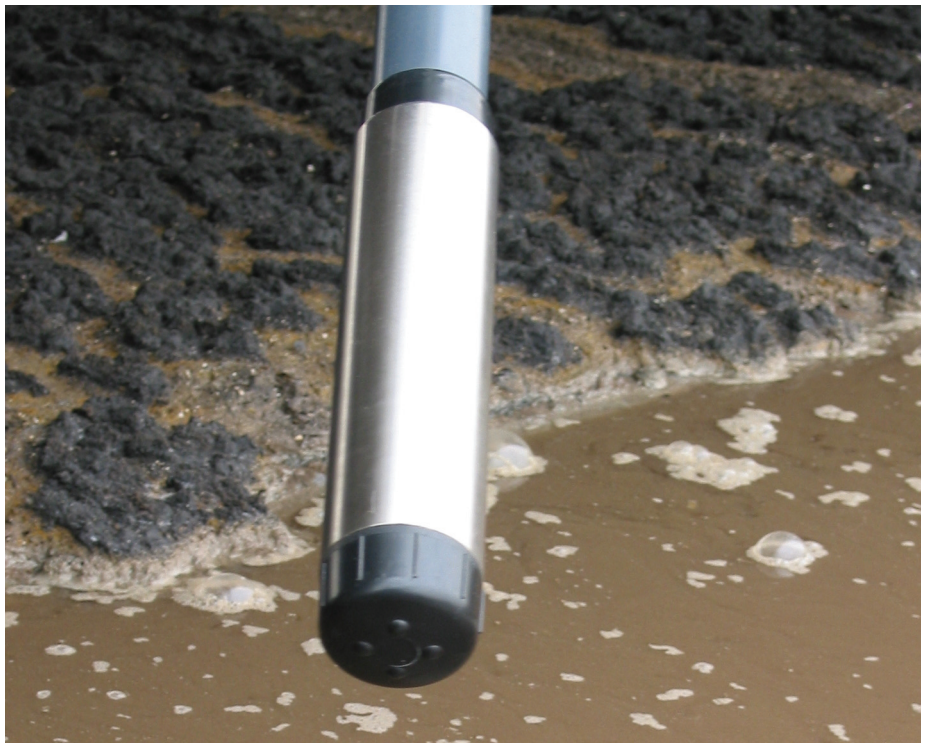
Mark Gibson is a Technical Adviser, Instrumentation Control and Automation for Northumbrian Water, and has put the LDO™ through its paces in two different applications. The plant at Bran Sands, Teesport, treats aggressive industrial effluent. Previously, DO probes on this site have suffered from damage to membranes and seals, and the high cost of ownership and maintenance was the main reason for the trial. There are 36 DO probes at Bran Sands and Mark comments wryly "someone is working on DO probes there frequently -however, an LDO™ was installed in July 2003, and has worked very well with no problems. One of the big benefits of the LDO™ was that no calibration was necessary at commissioning. Readings were spot-on from the start, and showed unbelievable correlation with existing probes." Mark also noticed that whilst accuracy remained very good over time, the response time grew, as the weeks passed, however, wiping the probe returns response time to what it was on installation.

Mark also tried the LDO™ at Washington STW from October 2003. There was a constant offset between the LDO™ and the existing probe. This condition was highlighted and became an issue at low DO levels when the LDO™ reported a zero reading. A laboratory solution was prepared of oxygen free water and both probes were tested. This test proved that the LDO™ gave correct DO levels and that the offset noted was due to incorrect values on the existing system. As the LDO™'s performance reduced due to fouling, longer periods of zero readings were logged. Once cleaned, the probe reported smaller periods of zero DO again correctly. This condition highlighted the fact that the basis of the measurement is down to a time measurement - increased fouling increases the time taken to reach correct DO readings. At Washington STW fouling occurred at about two months and Mark says that "we are more than happy with that", adding that "not having to calibrate on installation is a big benefit". LDO™ probes have since been acquired.

LDO probe

Southern Water tried the LDO™ at Newhaven and East Grinstead STWs, and Dave Manley reports that he is very pleased with its performance: "the only maintenance has been to wipe he probe every three to four weeks. Previously the DO probes had to undergo a long-winded calibration, involving a membrane change, chemicals, specialist training and safety specs which took about 30 minutes."

South West Water have used the LDO™ at Bratton Flemming STW (Exmoor) for about five months in a passive ditch. Nick Pester, a Service Team Leader, reports that "so far, the LDO™ has performed very well - no maintenance has been necessary except for occasional wiping. Previous membrane probes at this site had to be recalibrated every three months – an operation that took about an hour." Commenting further on the trial, Robin Lennox said that



LDO™ probe in activated sludge

Operator with LDO™ controller

"operational savings and improved plant control are always the objectives, and if the LDO™ proves able to provide these, it may supplant the position of South West's existing preferred supplier of DO probes". Gleesons have installed a biological nutrient removal system at one of Thames Water's sites, and following seven months work with the LDO™ Gleeson's John Egan comments that he " would like an instrument as reliable as the LDO™ to be specified every time". He has to recalibrate other probes every one to two weeks, at which point they match the LDO™, but they then drift. The LDO is in a system that suffers from a degree of biofouling, which can accumulate on the probe " if the probe becomes completely covered it gives a sudden zero reading. However, the beautiful thing is that there is no drift as long as even a small part of the probe can 'see'. Problems such as this are less obvious on probes that drift, which will result in excess energy losses on the plant".

David Foster, Senior Process Consultant, Engineering, for Thames Water has also been involved with this site, and says that Thames are certainly interested in the LDO™ and plan to put it through a formal evaluation.

Wessex Water's Louise Chant ran trials at Bridport in Dorset against traditional DO probes. She found that the LDO™ worked well even when 'ragged up', and that she "likes the LDO™ because the technology seems to be very effective, and the low maintenance requirement means that it can be left unattended for longer periods." More LDO™ probes are on order for elsewhere in the Wessex Water region.

Yorkshire Water's WWTW at Deighton near Huddersfield employs activated sludge to treat agrochemial waste. Yorkshire's Barry Robinson has used the LDO™ in this aggressive environment for over seven months and he too reports no problems. Initially, the LDO™ was installed as part of a triple validation system, in which Barry says " the other two probes gave the same reading as the LDO™, but had to be calibrated every week, which took about one hour for two probes." Following his experiences with the on-line LDO™, Barry also anticipates using the portable version in the future.

Conclusions

So, with the benefit of several months experience in a range of applications spread widely across the UK, do the users support Hach Lange's claims for the LDO™?
The answer has to be a resounding, "*Yes, they DO*". The UK water industry is not renowned for unanimity, but in this instance all users have reported great satisfaction with the LDO™ performance. It has required very little maintenance, other than occasional wiping and has maintained its accuracy over many months in which re-calibration has not been necessary.
On the basis of this information, the LDO™ will save the cost of excess aeration energy, and sensor consumables such as membranes, anodes, electrolyte etc and will also save plant operators significant time that was previously spent in maintenance and re-calibration.

Nikki Mellor, Hach Lange's UK Marketing Manager is obviously delighted with the feedback from customers and reports that "*both the portable and on-line version of the LDO™ are selling like hot cakes, and the sales of DO consumables are in serious decline!*"